Rocz Panstw Zakl Hig 2023;74(3):295-307
http://wydawnictwa.pzh.gov.pl/roczniki_pzh/ https://doi.org/10.32394/rpzh.2023.0268

ORIGINAL ARTICLE

IMPACT OF THE COVID-19 PANDEMIC ON THE CHANGES IN DIETARY HABITS, LIFESTYLE AND PHYSICAL ACTIVITY IN THE SLOVAK POPULATION

Marta Lorková[1], Martina Gažarová[2]

[1]AgroBioTech Research Center, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 76 Nitra, Slovak Republic
[2]Institute of Nutrition and Genomics, Faculty of Agrobiology and Food Resources, Slovak University of Agriculture in Nitra, Tr. A. Hlinku 2, 949 76 Nitra, Slovak Republic

ABSTRACT

Background. Background. The COVID-19 pandemic caused by the coronavirus was accompanied by the emergence of various adverse conditions, as well as the deterioration of health from the point of view of chronic diseases, as well as lifestyle changes related to the preference of certain foods and changes in body weight due to the restriction of free movement.

Objective. The objective of our survey was to assess the impact of the pandemic and lockdown on selected key lifestyle elements affecting the overall health status of the Slovak population and subsequently to evaluate subjectively assessed changes in the respondents' eating habits, daily routine, physical activity and body weight.

Material and Methods. The research group consisted of 528 participants who took part in an online distributed questionnaire survey.

Results. Respondents subjectively evaluated the change in lifestyle rather negatively. Up to 48.37% of men and 38.93% of women reported a change for the worse. Almost 59% of participants reported no change in their health, while almost a quarter reported a slight deterioration in their health. A change in eating habits for the worse was reported by 22.88% of men and 28.26% of women ($p<0.05$). Increased appetite during the lockdown was reported by 24.18% of men and 35.47% of women ($p<0.05$), more frequent overeating during the pandemic occurred in 30.07% of men and 38.13% of women. When evaluating the consumption of individual food commodities, the increased consumption of fresh fruit, fresh vegetables ($p<0.01$), homemade bread ($p<0.05$), homemade pastries ($p<0.05$) and dairy products ($p<0.05$) is very favourable. We also found a significant increase in the consumption of sweets ($p<0.01$) and coffee ($p<0.001$). When evaluating the sleep pattern, we noted an increase in sleep during the pandemic, as well as more time spent sitting. Over half of the respondents reported a change in body weight, in most cases it was an increase in both sexes.

Conclusions. The results show that the pandemic and the restrictions during it caused changes not only in diet, but also in physical activity, daily routine and overall lifestyle. However, this is a very specific issue that needs to be assessed in a comprehensive and strictly personalized manner. The positive or negative impact of the pandemic on the health of the population will be the subject of research in the near future.

Key words: *coronavirus, lockdown, diet, weight, physical inactivity, lifestyle behaviour*

INTRODUCTION

The COVID-19 pandemic, which is caused by the SARS-CoV-2 coronavirus, swept almost the entire world in the previous period. An outbreak of acute community-acquired atypical pneumonia of unknown aetiology was first registered in December 2019 in Wuhan, the capital of Hubei Province in central China [1]. The virus is believed to be acquired from a zoonotic source and spreads through direct contact transmission [2]. It started spreading via cross-species transmission from animal to human and spreads further via a human-to-human transmission [3]. Typical symptoms of COVID-19 infection can demonstrate a clinically diverse manifestation, ranging from asymptomatic presentation to critical illness with severe pneumonia, acute respiratory distress syndrome, respiratory failure, or multiple organ failure [4], septic shock and fatalities [5].

Corresponding author: Martina Gažarová, Slovak University of Agriculture, Faculty of Agrobiology and Food Resources, Institute of Nutrition and Genomics, Tr. A. Hlinku 2, 949 76 Nitra, Slovakia, phone: +421 37 641 4210, e-mail: martina.gazarova@uniag.sk; martina.gazarova@gmail.com

Publisher: National Institute of Public Health NIH - National Research Institute

Transmission of SARS-CoV-2 usually occurs through respiratory droplets. The average incubation period is 6.4 days, and symptoms usually include fever, cough, dyspnoea, myalgia, or fatigue [6,7], which can be fatal for vulnerable individuals [8,9]. Coronavirus disease, called COVID-19 (Corona virus disease 2019), after China quickly spread to most countries in the world, the WHO on March 11, 2020, declared a pandemic caused by this virus [5]. The pandemic has resulted in great loss of life and considerable economic damage [10,11].

Researchers have reported that the virus is constantly evolving and spreading through asymptomatic carriers, further suggesting a high global health threat [12].

Although most of the COVID-19 patients were mild and could gradually recover after two weeks, about 15-20% of patients developed severe interstitial pneumonia [13].

Many risk factors have been identified in the progression of COVID-19 into a severe and critical stage, including old age, male gender, underlying comorbidities such as hypertension, diabetes, and obesity [14], chronic lung diseases, heart, liver and kidney diseases, tumours, clinically apparent immunodeficiencies, local immunodeficiencies [15].

The Slovak Republic was no exception. The first case of COVID-19 was recorded on March 6, 2020, and a week later, a state of emergency was declared, and with it, countless measures, prohibitions and restrictions were introduced [16].

In the fight against the spread of the pandemic, lockdowns were introduced, social contacts were limited and work from home was preferred. All of this had an impact on changing of the residents' behaviour [17, 18].

The COVID-19 pandemic is associated with negative psychosocial consequences, including depressive symptoms, anxiety, anger and stress, sleep disorders, symptoms of post-traumatic stress disorder, social isolation, loneliness and stigmatization with adults and children [5, 19, 20].

Stressors can trigger binge eating [21]. During prolonged stress, our bodies release cortisol, which increases the hunger sensation [22, 23]. The best recommendation for staying healthy during quarantine is to follow general health advice such as eating a balanced diet, staying hydrated, being physically active, getting enough sleep, and managing stress [24].

Getting back to better dietary habits is more critical now than ever to enhance the body's immune system as the virus continues to spread. The necessity to live well and keep healthy is now a priority. Therefore, there are some recommendations to do this [25].

Eating a well-balanced diet, focused on fruits, vegetables, whole grains, plant and animal protein, and healthy fats is the best way to get all the essential nutrients we need for good health and normal immune function [26]. This diet formula contains essential vitamins such as C, D, E, zinc, omega-3 and polyunsaturated fatty acids [25, 27], which have shown potential in their anti-inflammatory effects [28].

Identified risk factors for weight gain during COVID-19 self-quarantine are the following: increased sedentary behaviours, decreased physical activity, increased snacking frequency (particularly after dinner), increased alcohol intake, decreased water intake, emotional eating, decreased sleep quality [29]. The aim of our survey, carried out using the questionnaire method, was to map and assess the impact of the pandemic on the eating regime of consumers and subsequently evaluate changes in the respondents' lifestyle and physical activity.

MATERIAL AND METHODS

Characteristics of the research group and implementation of the survey

A cross-sectional retrospective online survey was conducted among residents of the Slovak Republic during the COVID-19 pandemic in the period between March 30, 2021 and December 15, 2021. Respondents from all regions of Slovakia were approached. Participation in the study was strictly voluntary and anonymous. At the beginning of the questionnaire, there was a brief description and purpose of the survey, assuring the respondents of anonymity and confidentiality. We did not ask for any contact or identification data from the respondents. The participants gave us their consent to process the provided data in accordance with the Personal Data Protection Act. The study was conducted in accordance with the Declaration of Helsinki and General Data Protection Regulation of the European Parliament (GDPR 679/2016).

The questionnaire was distributed *via* the Google Forms web platform. The reference source and link to the questionnaire was a link shared *via* emails, social media and networks. The questionnaire was distributed in the Slovak language (the official language), which ensured good comprehensibility for the respondents. It was validated by the experts from the Institute of Statistics, Operation Research and Mathematics SUA in Nitra.

From the total number of 616 responses, after excluding inappropriate respondents, we obtained a final number of 528 responses (375 women, 153 men). For the purposes of the survey, we chose the following exclusion criteria: age less than 18 years; persons with a severe course of chronic infectious or non-infectious diseases; people with eating disorders; persons with specific nutritional needs; persons with

an applied reduction or nutritional diet; pregnant women during the pandemic; breastfeeding women during the pandemic; pregnant women in the period one year before the outbreak of the pandemic; persons living abroad.

Questionnaire survey

The questionnaire was divided into several thematic areas. In the beginning, the questions were aimed at socio-demographic identification, concerning the age, place of residence, way of living, highest education achieved, duration of lockdown or movement restrictions, current job classification, in the case of employees, we asked about the way of performing work during the lockdown, on the family's monthly income, and we were also interested in how often the respondents left their home during the lockdown period and for what reason.

The age of respondents was divided into three categories (18-24 years; 25-64 years; ≥65 years). The place of residence could be classified as living in the town or in the rural with a choice of options in a family house or in an apartment building. The highest education attained was divided into five categories (primary; vocational; secondary; higher secondary; university). The duration of the lockdown was divided into four categories (less than 1 month; 1 to 3 months; 4 to 6 months; more than 6 months). Within the current job classification, the respondents chose one of the options (student; employed; unemployed; pensioner). Employees subsequently chose from four options for the implementation of their work (home office; alternative; at work; work disability). They chose the monthly family income from the categories (less than 1000 euros; 1000-2000 euros; 2000-3000 euros; more than 3000 euros). Leaving the residence during the lockdown within a week was divided into three possibilities (5 to 7 times a week; 1 to 4 times a week; I don't go out) and its reasons were classified as follows (doctor visiting; caring for a loved one; shopping; work/school; sport). Respondents were asked about their current height and weight. Based on this information, we determined actual BMI. Four categories were identified: underweight (<18.5 kg/m^2), normal weight (18.5-25.0 kg/m^2), overweight (25.0-30.0 kg/m^2) and obesity (≥30.0 kg/m^2). Subsequently, the respondents had to indicate the change in weight and the change in waist circumference during the pandemic by choosing from the options (unchanged; increased; decreased). We also asked about overcoming the COVID-19 disease (yes/no).

In the next part, it focused on questions evaluating changes during the pandemic. We asked the respondents if their lifestyle had changed. They chose answers from four options (I do not know; no; yes, for the worse; yes, for the better). We asked about the change in health status, and the respondents evaluated it subjectively by choosing from the options (didn't change; slightly improved; radically improved; slightly worsened; radically worsened). Respondents should also evaluate a possible change in eating habits by choosing from the options (no; yes, for the worse; yes, for the better), change in appetite (no; yes, it increased; yes, it reduced) and overeating (yes/no). As part of the lifestyle, we asked the respondents about changes, including questions about the daily routine, physical activity and sleep routine. As part of daily activities, they had the opportunity to choose from the following options, such as sport/physical activity; sitting; lying; walking, while the duration of the activity was stated in hours per day and the change in duration during the pandemic (increased; decreased; did not change).They evaluated physical activity before the pandemic (yes/not) and its change during the pandemic by choosing from the options (yes, for the worse; yes, for the better; I do not know; not). Regarding the frequency of playing sports before and during the pandemic, respondents chose from four options (did not play sports; 1 to 2 times a week; 3 to 4 times a week; more than 5 times a week).

Sleep mode was evaluated by the length of sleep duration (less than 7 hours; 7 to 9 hours; more than 9 hours), during and before the pandemic.

This was followed by questions focused on the intake of food products and meals (fresh fruit; fresh vegetables; frozen fruit; frozen vegetables; canned fruit; canned vegetables; nuts; pasta and cereals; homemade bread; homemade pastries; bought bread; bought pastries; legumes; sweets; dark chocolate; processed meat – ham, salami; dairy products; cheese; cow milk; goat milk; yogurt; eggs; frozen, chilled fish; canned fish; coffee; green tea; herbal tea; sugar and other sweeteners; honey; sweetened and sparkling drinks; vegetable juices; fruit juices; fast food meals; delivery pizza; delivery meals in general; homemade meals; snacks) and changes in their consumption that occurred compared to the period before the pandemic (increased; decreased; unchanged).

Statistical analysis

All data were processed using Microsoft Office Excel 2016 (Los Angeles, CA, USA) in combination with XLSTAT (Data Analysis and Statistical Solution for Microsoft Excel, Addinsoft, Paris, France 2017, version 2019). Variables were expressed as a relative number (%). For observable parameters, results were evaluated through descriptive statistics, for data evaluating change over a certain period, data analysis was performed using the chi-square test, and the level of statistical significance was set at $p<0.05$. All statistical analyses were performed using Statistica 13.0 software (TIBCO Software Inc., Palo Alto, CA, USA).

RESULTS

The research group consisted of a total of 528 participants, their age ranged from 18 to 82 years (respondents younger than 18 were excluded from the group based on the exclusion criteria). In total, there were 375 women (average age of 31.77 ± 13.90 years) and 153 men (average age of 29.70 ± 12.57 years). The most represented age category was ≤24 years for both sexes. From a demographic point of view, all regions within the Slovak Republic were covered. The rural-urban distribution of the population was more in favor of the urban population at the level of 55.68%, while people living in a family house had a larger share (58.82%). Most of the interviewees had completed secondary education and were employed. At the time of our survey, as many as 34.93% of women and 36.60% of men said that they had been in lockdown for more than 6 months. An average of 21.35% of respondents did their work from home. On the contrary, 51.98% of women and 64.44% of men worked at the workplace. During the lockdown, people most often went outside the home 1 to 4 times a week (53.15%) and their reasons were as follows: work/school, shopping, sports, caring for a loved one and visiting a doctor (44.01 vs 35.29 vs 15 .01 vs 3.86 vs 1.83%, respectively). The current body weight of participating women was 65.63 ± 14.25 kg and men 85.12 ± 14.40 kg. In the evaluation of the survey group, the BMI value was within the norm (24.51 kg/m^2). Within the male group, we recorded on average higher BMI values classified as overweight (25.51 kg/m^2). We found that 30.49% of subjects overcame the disease of COVID-19 in the mentioned period, of which more women (33.51%) than men (22.87%). Detailed information on the demographic composition of the studied group is in Table 1.

Table 1.Characteristics of the studied group

Gender	Total (n=528) %	Women (n=375) %	Men (n=153) %
Age			
≤ 24	49.62	48.80	51.63
25 - 64	47.56	48.00	46.40
≥ 65	2.84	3.20	1.96
Place of residence			
city	55.68	55.73	55.56
countryside	44.32	44.27	44.44
Habitation			
in an apartment building	41.17	43.24	36.60
in a family house	58.82	56.76	63.40
Education			
primary	5.11	4.27	7.19
vocational	3.78	2.40	7.19
secondary	48.29	49.07	46.41
higher secondary	2.46	1.33	5.23
university	40.34	42.93	33.99
Lockdown			
less than 1 month	20.45	19.2	23.53
1 to 3 months	20.07	20.8	18.30
4 to 6 months	24.05	25.07	21.57
more than 6 months	35.17	34.93	36.60
Status			
the student	42.04	44.27	36.60
employed	52.21	47.20	58.82
unemployed	6.07	5.07	2.61
pensioner	0.33	3.47	1.96
In the case of employees, the work is performed			
home office	21.35	22.60	18.89
alternative	20.59	23.16	15.56
at work	56.18	51.98	64.44
work disability	1.87	2.26	1.11

Monthly family income			
less than 1000	35.49	39.41	26.80
1000 - 2000	50.71	47.94	56.86
2000 - 3000	9.93	9.12	11.76
more	3.86	3.53	4.58
Staying away from home during the lockdown			
5 to 7 times a week	38.94	36.47	44.44
1 to 4 times a week	53.15	55.59	47.71
I don't go out	7.91	7.94	7.84
Reason for staying away from home during lockdown			
the doctor	1.83	1.76	1.96
caring for a loved one	3.86	2.35	7.19
shopping	35.29	40.89	22.87
work/school	44.01	40.58	51.63
sport	15.01	14.41	16.34
Current weight (kg)			
mean	75.37	65.63	85.12
standard deviation	14.32	14.25	14.40
max	160	160.00	148.00
min	36.5	36.50	60.00
BMI (kg/m^2)			
mean	24.51	23.51	25.51
standard deviation	4.45	4.92	3.69
max	59.48	59.49	39.12
min	13.57	13.57	18.94
Overcoming COVID-19			
yes	30.49	33.51	22.87
not	69.51	66.49	77.12

The results of our survey show that during the pandemic and lockdown there were changes not only in diet, but also in physical activity, daily routine and overall lifestyle.

The respondents themselves subjectively evaluated the change in lifestyle rather negatively. Up to 48.37% of men and 38.93% of women reported a change for the worse. Almost 59% of participants reported no change in their health status, and almost a quarter of participants reported a slight deterioration in their health status. A change in eating habits for the worse was reported by 22.88% of men and 28.26% of women ($p<0.05$). Increased appetite during lockdown was reported by 24.18% of men and 35.47% of women ($p<0.05$). More frequent overeating during the pandemic occurred in 30.07% of men and 38.13% of women. Details are provided in Table 2.

Changes in diet were also reflected in the selection and consumption of individual foods. We positively assess the increase in the consumption of fresh fruit and fresh vegetables by both men and women. In the case of consumption of fresh vegetables, there was a significant change ($p<0.05$). The same was found in the case of frozen fruit consumption ($p<0.05$). The change in the increase in the consumption of nuts in both sexes is also favourable. Consumption of homemade bread ($p<0.05$) and homemade pastries ($p<0.05$) increased significantly in both sexes. For women, the consumption of bought bread and pastries decreased significantly, but for men, on the contrary, it increased. The fact of increased consumption of sweets ($p<0.01$) is unfavourable. Regarding the consumption of meat products, we have seen a slight increase in consumption compared to the period before the pandemic. The consumption of dairy products increased significantly ($p<0.05$). During the pandemic, however, we noticed a decrease in the consumption of cow's and goat's milk among women, and a decrease in the consumption of only goat's milk among men. In the observed period, the consumption of coffee ($p<0.001$) and herbal teas ($p<0.01$) increased. We favourably evaluate the decrease in the consumption of sugar and sweetened beverages, even if it was not a significant change. We also noted a significant increase in honey consumption ($p<0.01$). Probably under the influence of the measures, the consumption of delivery meals and pizza and fast-food meals decreased, while the consumption of home-prepared meals increased significantly ($p<0.01$). The data are summarized in Table 3.

Table 2. Lifestyle changes during the pandemic

Gender	Total %	Women %	Men %	p
Lifestyle changes during the pandemic				
I do not know	13.45	15.47	8.50	0.104
not	26.52	26.13	27.45	
yes, for the worse	41.67	38.93	48.37	
yes, for the better	18.37	19.47	15.69	
Has your health changed during the pandemic?				
didn't change	58.71	58.93	58.17	0.529
slightly improved	11.93	11.20	13.73	
radically improved	3.79	3.47	4.58	
slightly worsened	23.11	23.47	22.22	
radically worsened	2.46	2.93	1.31	
Have your eating habits changed during the pandemic?				
not	48.30	44.53	57.52	0.023
yes, for the worse	26.70	28.26	22.88	
yes, for the better	25.00	27.21	19.61	
Your appetite has changed during the pandemic?				
not	57.95	54.67	66.01	0.034
yes, she increased	32.20	35.47	24.18	
yes, she reduced	9.85	9.87	9.80	
Did you overeat during the pandemic?				
yes	35.80	38.13	30.07	0.079
not	64.20	61.87	69.93	

Restrictions during the pandemic had a huge impact on daily routine and physical activity. A change in physical activity for the worse was reported by 40.5% of women and 46.4% of men. During the pandemic, almost 30% of women and men did not exercise at all, and the number of people exercising regularly decreased (Figure 1).

When monitoring the daily routine, we evaluated the time (in hours) spent sitting, lying down, walking or doing physical activity. Women sat an average of 6.95 ± 3.46 hours during the day and men 7.26 ± 3.86 hours. Women spent an average of 9.76 ± 2.36 hours per day licking or sleeping and men 9.44 ± 1.89 hours per day. In contrast, we noted a decrease in the time spent walking (women walking 1.21 ± 0.88 hours a day and men 1.27 ± 1.26 hours a day; Table 4 and Table 5).

Due to the impact of the pandemic, the number of people who adhere to the recommended length of sleep of 7 to 9 hours has increased, which we evaluate very positively, and at the same time, the number of people with shorter sleep duration has decreased. Figure 2 shows changes before and during the pandemic for both genders.

Table 3. Food preferences changes during the pandemic

Type of food	Women (n=375)			Men (n=153)			p
	increased %	decreased %	unchanged %	increased %	decreased %	unchanged %	
fresh fruit	30.67	8.00	61.33	21.57	6.54	71.90	0.067243
fresh vegetables	39.20	7.73	53.07	24.18	6.54	69.28	0.002256
frozen fruit	13.60	11.73	74.67	7.19	8.50	84.31	0.045894
frozen vegetables	20.80	8.80	70.40	15.03	10.46	74.51	0.291187
canned fruit	8.00	11.73	80.27	7.84	9.15	83.01	0.682496
canned vegetables	8.53	9.87	81.60	9.80	8.50	81.70	0.813605
nuts	24.80	8.00	67.20	16.34	6.54	77.12	0.070129
pasta and cereals	34.40	9.60	56.00	35.29	4.58	60.13	0.155812

homemade bread	16.80	13.60	69.60	15.03	6.54	78.43	0.04792
homemade pastries	16.27	13.60	70.13	13.07	5.88	81.05	0.016706
bought bread	14.40	25.87	59.73	21.57	16.99	61.44	0.028523
bought pastries	15.47	25.87	58.67	23.53	16.34	60.13	0.015958
legumes	17.33	9.07	73.60	11.76	7.84	80.39	0.223835
sweets	36.53	21.07	42.40	28.10	14.38	57.52	0.006368
dark chocolate	15.47	10.93	73.60	10.46	9.80	79.74	0.269908
processed meat (ham, salami)	22.40	18.93	58.67	28.10	12.42	59.48	0.123182
dairy products	29.33	13.07	57.60	20.26	9.15	70.59	0.020931
cheese	33.33	9.07	57.60	26,14	8.50	65.36	0.23105
cow milk	12.00	14.67	73.33	10.46	7.84	81.70	0.073723
goat milk	2.13	9.07	88.80	0.65	9.80	89.54	0.480403
yogurt	26.40	15.47	58.13	22.22	10.46	67.32	0.122033
eggs	35.73	7.73	56.53	29.41	6.54	64.05	0.281087
frozen, chilled fish	18.93	11.20	69.87	15.69	5.88	78.43	0.085447
canned fish	16.53	12.53	70.93	11,11	7.84	81.05	0.055607
coffee	44.00	7.20	48.80	27.45	14.38	58.17	0.000436
green tea	25.33	10.67	64.00	16.99	8.50	74.51	0.060871
herbal tea	40.00	5.07	54.93	25.49	3.92	70.59	0.003753
sugar and other sweeteners	14.93	26.67	58.40	12.42	18.30	69.28	0.057518
honey	29.60	8.27	62.13	16.99	11.11	71.90	0.009967
sweetened and sparkling drinks	13.87	29.07	57.07	14.38	22.88	62.75	0.342286
vegetable juices	11.47	6.40	82.13	8.50	11.76	79.74	0.085786
fruit juices	22.93	13.33	63.73	22.88	12.42	64.71	0.957991
fast food meals	8.53	35.47	56.00	14.38	33.99	51.63	0.13021
delivery pizza	16.53	28.53	54.93	18.95	21.57	59.48	0.252045
delivery meals in general	16.00	26.93	57.07	19.61	18.30	62.09	0.099601
homemade meals	54.13	5.07	40.80	37.91	3.92	58.17	0.001333
snacks	26.67	10.67	62.67	24.18	12.42	63.40	0.753531

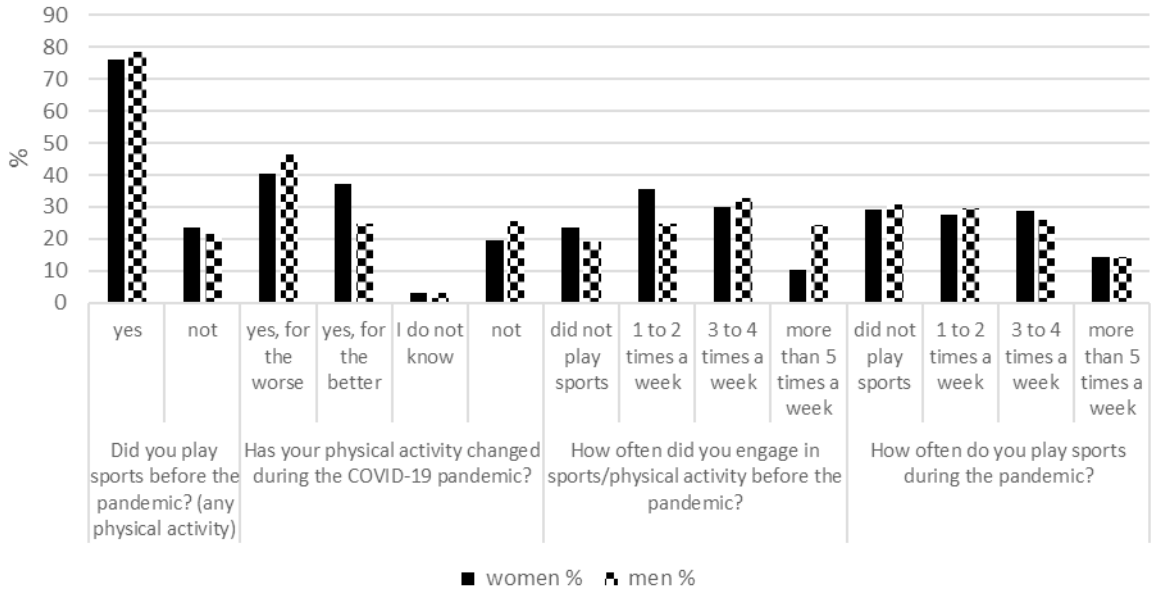

Figure 1. Physical activity changes during the pandemic

Table 4. Daily routine during a pandemic in hours per day

Activity		Women	Men
Physical activity (hour/day)	min	0	0
	max	7.14	8.57
	mean	1.07	1.27
Sitting (hour/day)	min	1.00	1.00
	max	21.00	20.00
	mean	6.95	7.26
Lying (hour/day)	min	4.00	4.00
	max	20.00	15.00
	mean	9.76	9.44
Walking (hour/day)	min	0	0
	max	8.00	7.50
	mean	1.21	1.27

Table 5. Changes in the duration of daily activities during the pandemic

Activity	Women (%)			Men (%)			p
	increased	decreased	Didn't change	increased	decreased	didn't change	
Sitting	62.40	10.40	27.20	56.86	7.19	35.95	0.10397
Lying	56.18	8.53	35.29	55.56	6.54	37.91	0.10921
Walking	27.73	43.73	28.53	19.61	43.79	36.60	0.07737

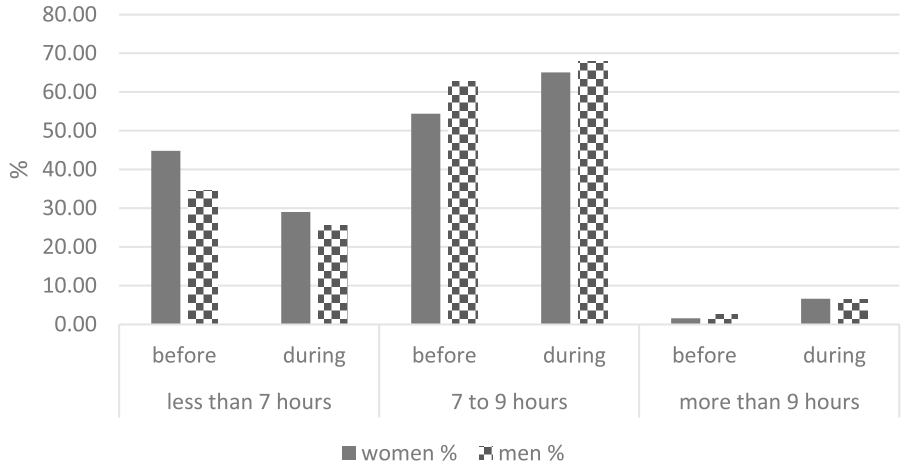

Figure 2. Changes in sleep mode under the influence of the pandemic

All the mentioned circumstances could also influence the change in weight and body composition of the monitored respondents. The findings are presented in Table 6 and Table 7. Changes in body weight were reported by up to 59.28% of participants (61.44% of men, 58.40% of women). A decrease in body weight was reported by 34.2% of women (average -5.48 ± 3.27 kg), in men weight loss was recorded in 28.72% of cases and the average weight loss was -7.24 ± 4.94 kg. An increase in body weight was reported by 65.8% of women (an average of 5.12 ± 3.18 kg). In men, the average weight gain was 5.91 ± 4.49 kg, which we recorded in 72.3% of men. Similarly, we monitored changes in waist circumference. Almost half of men and women reported unchanged waist circumference, but in the case of changes, it was mostly an increase in waist circumference for both men and women (35.29% and 31.73%, respectively).

DISCUSSION

The results of our work show that the previous periods of the pandemic have greatly affected several areas of life. Of the participants who participated in our survey 24.9%, performed their work remotely. *Błaszczyk-Bębenek* et al. [30] reported a higher

Table 6. Changes in body weight, waist and hip circumference under the influence of the pandemic

	Men (%)			Women (%)			p
	I do not know	yes	not	I do not know	yes	not	
Weight change	10.46	61.44	28.10	8.00	58.40	33.60	0.3776
	unchanged	increased	decreased	unchanged	increased	decreased	
Waist circumference change	50.33	35.29	14.38	49.87	31.73	18.40	0.4856
Hip circumference change	63.40	23.53	13.07	55.73	29.33	14.93	0.2609

Table 7. Body weight changes during the pandemic

Weight changes		
Decrease (kg)	Men 28.7%	Women 34.2%
average	7.24	5.48
standard deviation	4.94	3.27
max	20	15
min	1	1
Increase (kg)	Men 72.3%	Women 65.8%
average	5.91	5.12
standard deviation	4.49	3.18
max	20	15
min	1	1

percentage of people working remotely, almost 67% of the monitored group. Researchers Barone *Gibbs* et al. [31] found that participants had substantial changes in work practices, including 72% transitioning to telecommuting.

The restrictions of staying at home were also reflected in the intake of individual meals during the day. We noticed an increased percentage of people who introduced breakfast, but also the second dinner, into their menu. Korean adolescents also had more breakfast during the COVID-19 pandemic [32], which is important for health.

The self-assessment of changes in the diet of respondents of the Polish population during the lockdown showed that the majority of the studied group did not introduce any changes to their eating habits during the lockdown (32.4%) [30]. We can agree with a similar statement in the sample of our respondents, where 44.53% of women and 57.52% of men remained unchanged in their diet. In contrast, more than 38% of women and 30% of men said they overate and snacked during this period. Similar conclusions were reached by authors *Sidor* and *Rzymski* [33] who stated that 43.0% of individuals ate and snacked more, while these tendencies were more common in overweight and obese individuals.

Food consumption and eating habits (type of food, binge eating, snacking between meals, number of main meals) were more unhealthy during incarceration, with only excessive alcohol consumption significantly reduced [34].

All this led to a change in the number of foods consumed. It also manifested itself among respondents in the Slovak Republic, where we noted an increase in the consumption of fruits and vegetables, homemade pastries and bread, pasta, whole grain products and also sweets. Similar findings are reported by other authors *Zupo* et al. [35], who talk about a sharp increase in the consumption of carbohydrate sources, especially those with a high glycaemic index (i.e. homemade pizza, bread, cake and pastries), as well as more frequent snacks, also report higher consumption of fruits and vegetables. A Lithuanian study reports an increase in the consumption of homemade baked goods and fried foods [36]. After the introduction of restrictions, respondents in Poland changed the frequency of consumption of products such as eggs ($p=0.0022$), potatoes ($p=0.0004$), sweets ($p=0.0241$) and canned meat ($p=0.0004$), which were consumed more often during the lockdown. Fast food products and instant soups were consumed less frequently by the study group during lockdown [30].

The COVID-19 pandemic in Spain led to the adoption of healthier eating habits/behaviours in the study population by those individuals who reduced their intake of fried foods, snacks, fast food, red meat, pastries or sugary drinks, but increased MedDiet-related foods such as olive oil, vegetables, fruits or legumes [37]. A Lithuanian study confirmed a reduced intake of carbonated or sweetened beverages, fast food, and commercial baked goods [36].

Korean adolescents consumed less fruit, soda, and sugary drinks during the COVID-19 pandemic [32]. Among the Polish population, the most preferred drinks were tea and coffee [30]. Our survey also confirmed the increase in the consumption of coffee, tea and herbal teas, while we noted a decrease in the consumption of carbonated and sweetened beverages.

In the US, the majority of participants reported no change in eating habits (43.6–87.4%) for the listed foods and beverages. However, some participants reported increased consumption of sweets, including cakes (43.8%), potato chips or salty snacks (37.4%),

water (35.4%), coffee or tea (31.1%), white rice or pasta, alcoholic beverages, cold breakfast cereals, baked, mashed or boiled potatoes, starchy vegetables; beef, pork or lamb, processed meat and white bread. In addition, some participants reported reduced fruit consumption, eggs, chicken or turkey meat, non-starchy vegetables, dairy products and fish and shellfish. Participants also reported reduced consumption of nutritious foods such as nut butter, nuts or seeds, brown rice or whole grain pasta, wholemeal bread and oils [38].

The increase in body weight in the majority of respondents corresponds to the findings of other authors. For example, in Poland [30] more than 2/3 of participants reported a change in body weight, with 45.86% of participants being overweight during lockdown. The authors of the second research in Poland [33] indicate an increase in body weight in 30% of respondents (3.0 ± 1.6 kg) and more than 18% reported weight loss (-2.9 ± 1.5 kg). The researcher *Zeigler* [29] found that among those who gained weight during the COVID-19 quarantine, self-reported body weight increased by 0.5 to 1.8 kg (± 2.8 kg) after only 2 months of quarantine. The perception of weight gain was observed in 48.6% of the population in Italy [39]. Lithuanian study states that almost half of the respondents (49.4%) ate more than usual. Every third (31.5%) respondents, more often already overweight, gained weight [36]. In our survey, a change in weight was recorded in 61.44% of men and 58.4% of women, while in most cases there was an increase in body weight by an average of 5.91 kg in men and 5.12 kg in women. We found a decrease in body weight in 28.7% of men by an average of -7.24 kg and in 34.2% of women by an average of -5.48 kg. The COVID-19 pandemic has also affected physical activity. The results of an Italian study reported slightly increased physical activity, especially when training with one's own weight, namely 38.3% of respondents [39]. In contrast, respondents in the Lithuanian study (60.6%) report a significant decrease in physical activity [36, 40]. Many participants in the UK revealed that they gained weight during lockdown due to reduced activity from work from home and changes in diet and exercise, leading to discomfort and dissatisfaction with perceived body image [41]. In a Spanish study, a significant proportion of participants reported significant changes in lifestyle behaviour during the COVID-19 pandemic, up to 93.6% and changes in physical activity by 70.2% [42].

The COVID-19 home confinement had a negative impact on all levels of physical activity intensity (vigorous, moderate, walking and total). In addition, daily sitting time increased from 5 to 8 hours per day [34]. The results of our survey also show more significant decrease in physical activity and an increase in the number of hours of sitting in men (7.26 ± 3.86 hours/day) and in women (6.95 ± 3.45 hours/day) and lying-in men (9.44 ± 1.86 hours/day) and women (9.76 ± 2.35 hours/day).

In the Spanish population, weight gain and a significant decrease in physical activity (minutes per week, 8515.7 ± 10260.0 vs 5053.5 ± 5502.0, $p<0.001$) were observed during the pandemic [43]. American study found out that exercise decreased by 34.5% [38]. Surprisingly among students, authors [44] reported an increase in physical activity, but also an increase in sitting time. The results of studies on Italian students indicate increased sitting time [45]. Reduced physical activity and long-term sedentary behaviour can negatively affect the physical and mental health of children and adolescents [46]. The results of other authors [47] in a rapid review study conducted in Asian and European countries with only four being American studies showed that COVID-19 is associated with a significant reduction in mobility, walking and physical activity and increased sedentary activity.

The main health and metabolic consequences of a several-week reduction in physical activity and the number of daily steps in combination with unhealthy eating habits are increased insulin resistance, increased body and abdominal fat, as well as inflammatory cytokines [48]. While social distancing is a safe strategy to reduce the spread of COVID-19, it is also the cause of increased sedentary behaviour. This behaviour creates excess adipose tissue, leading to metabolic and inflammatory disorders associated with chronic diseases and mental health disorders such as anxiety, depression, and sleep problems [49]. Poor quality sleep can negatively affect physical and mental health, as well as reduce the ability of the immune system to resist infections [50]. In our study, the number of people who slept less than 7 hours decreased, but on the contrary, the number of people who slept more than 9 hours increased. Compared with 7 h sleep duration, long sleep duration (≥9 h) was significantly associated with low levels of high-density lipoprotein cholesterol (HDL-C) [51]. *Kruisbrink* et al. [52] are inclined to believe that long sleep was associated with the risk of dyslipidemia. Long sleep duration is significantly associated with a high level of total cholesterol [50].

Results suggest that COVID-19 has exacerbated current obesity risk factors and is likely to exacerbate obesity rates in the near future. Future studies and policy makers will need to carefully consider their interdependence in order to develop effective interventions capable of mitigating the obesity pandemic [53].

CONCLUSIONS

The COVID-19 pandemic and the restrictive measures in several phases have affected many aspects of our way of life with certain consequences. The respondents themselves in our survey subjectively evaluated the change in lifestyle rather negatively. However, more than half of the respondents stated that their health status had not changed. A fifth of men and almost a third of women reported a change in eating habits for the worse. Increased appetite during the lockdown occurred more often in women than in men, which was also reflected in the more frequent occurrence of overeating in women. Changes in diet were also reflected in the selection and consumption of foods. We found a positive increase in the consumption of fresh fruit and fresh vegetables, as well as home-prepared food. We favourably evaluate the decrease in the consumption of sugar and sweetened beverages, but the fact of the increased consumption of sweets is unfavourable. There was also an increase in the consumption of coffee, herbal teas and honey. Restrictions during the pandemic had a big impact on daily routine and physical activity. A change in physical activity for the worse was reported by more than a third of women and men. Due to the impact of the pandemic, the number of people who observed the recommended length of sleep increased. The vast majority of respondents reported a change in body weight, in most cases there was an increase in body weight. The results of our survey of the Slovak population show that during the pandemic and lockdown there were changes not only in diet, but also in physical activity, daily routine and overall lifestyle.

Acknowledgment

The study was supported by the Educational Grant Agency of the Ministry of Education, Science, Research and Sport of the Slovak Republic (KEGA 003SPU-4/2022) and Operational Programme Integrated Infrastructure for the project: Long-term strategic research of prevention, intervention and mechanisms of obesity and its comorbidities (IMTS: 313011V344), co-financed by the European Regional Development Fund and Cultural.

Conflict of interest

There were no conflicts of interest.

REFERENCES

1. *To, K.K., Sridhar, S., Chiu, K.H., Hung, D.L., Li ,X., Hung, I.F., Tam, A.R., Chung, T.W., Chan, J.F., Zhang, A.J., Cheng, V.C., Yuen, K.Y.:* Lessons learned 1 year after SARS-CoV-2 emergence leading to COVID-19 pandemic Emerging Microbes & Infections 2021;10(1):507-535. https://doi.org/10.1080/22221751.2021.1898291
2. *Umakanthan, S., Sahu, P., Ranade, A.V., Bukelo, M.M., Rao, J.S., Abrahao-Machado, L.F., Dahal, S., Kumar, H., Kv, D.:* Origin, transmission, diagnosis and management of coronavirus disease 2019 (COVID-19). Postgraduate Medical Journal 2020;96(1142):753-758. doi: 10.1136/postgradmedj-2020-138234. https://pmj.bmj.com/content/96/1142/753.long
3. *Habas, K., Nganwuchu, C., Shahzad, F., Gopalan, R., Haque, M., Rahman, S., Majumder, A.A., Nasim, T.:* Resolution of coronavirus disease 2019 (COVID-19). Expert Review of Anti-infective Therapy 2020;18(12):1201-1211. https://doi.org/10.1080/14787210.2020.1797487
4. *Tsai, P.H., Lai, W.Y., Lin, Y.Y., Luo, Y.H., Lin, Y.T., Chen, H.K., Chen, Y.M,, Lai, Y.C,, Kuo, L.C,, Chen, S.D., Chang, K.J., Liu, C.H., Chang, S.C,, Wang, F.D., Yang, Y.P.*: Clinical manifestation and disease progression in COVID-19 infection. Journal of the Chinese Medical Association 2021;84(1):3-8. doi: 10.1097/JCMA.0000000000000463. https://journals.lww.com/jcma/Fulltext/2021/01000/Clinical_manifestation_and_disease_progression_in.2.aspx
5. *Sinanović, O., Muftić, M., Sinanović, S.:* COVID-19 Pandemia: Neuropsychiatric Comorbidity and Consequences. Psychiatria Danubina 2020;32(2):236-244. https://doi.org/10.24869/psyd.2020.236
6. *Ochani, R., Asad, A., Yasmin, F., Shaikh, S., Khalid, H., Batra, S., Sohail, M.R., Mahmood, S.F., Ochani, R., Hussham Arshad, M., Kumar, A., Surani, S.*: COVID-19 pandemic: from origins to outcomes. A comprehensive review of viral pathogenesis, clinical manifestations, diagnostic evaluation, and management. Le Infezioni in Medicina 2021;29(1):20-36. PMID: 33664170. https://www.infezmed.it/media/journal/Vol_29_1_2021_3.pdf
7. *Yüce, M., Filiztekin, E., Özkaya, K.G.*: COVID-19 diagnosis -A review of current methods. Biosens Bioelectron 2021;172:112752. doi: 10.1016/j.bios.2020.112752. https://doi.org/10.1016/j.bios.2020.112752
8. *Atzrodt, C.L., Maknojia, I., McCarthy, R.D.P., Oldfield, T.M., Po, J., Ta, K.T.L., Stepp, H.E., Clements, T.P.:* A Guide to COVID-19: a global pandemic caused by the novel coronavirus SARS-CoV-2. The FEBS Journal 2020;287(17):3633-3650. https://doi.org/10.1111/febs.15375
9. *Lotfi, M., Hamblin, M.R., Rezaei, N.*: COVID-19: Transmission, prevention, and potential therapeutic opportunities. Clinica Chimica Acta 2020;508:254-266. https://doi.org/10.1016/j.cca.2020.05.044
10. *Zabetakis, I., Lordan, R., Norton, C., Tsoupras, A.:* COVID-19: The Inflammation Link and the Role of Nutrition in Potential Mitigation. Nutrients 2020;12(5):1466. https://doi.org/10.3390/nu12051466
11. *Garzillo, E.M., Cioffi, A., Carta, A., Monaco, M.G.L.*: Returning to Work after the COVID-19 Pandemic Earthquake: A Systematic Review. International Journal of Environmental Research and Public Health 2022;19(8):4538. https://doi.org/10.3390/ijerph19084538

12. *Sharma, A., Ahmad Farouk, I., Lal, S.K.*: COVID-19: A Review on the Novel Coronavirus Disease Evolution, Transmission, Detection, Control and Prevention. Viruses 2021;13(2):202. https://doi.org/10.3390/v13020202
13. *Pan, F., Yang, L., Li, Y., Liang, B., Li, L., Ye, T., Li, L., Liu, D., Gui, S., Hu, Y., Zheng, C.*: Factors associated with death outcome in patients with severe coronavirus disease-19 (COVID-19): a case-control study. International Journal of Medical Sciences 2020;17(9):1281-1292. doi: 10.7150/ijms.46614. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7294915/#
14. *Pollard, C.A., Morran, M.P., Nestor-Kalinoski, A.L.:* The COVID-19 pandemic: a global health crisis. Physiological Genomics 2020;52(11):549-557. https://doi.org/10.1152/physiolgenomics.00089.2020
15. *Gao, Y.D., Ding, M., Dong, X., Zhang, J.J., Kursat Azkur, A., Azkur, D., Gan, H., Sun, Y.L., Fu, W., Li, W., Liang, H.L., Cao, Y.Y., Yan, Q., Cao, C., Gao, H.Y., Brüggen, M.C., van de Veen, W., Sokolowska, M., Akdis, M., Akdis, C.A.:* Risk factors for severe and critically ill COVID-19 patients: A review. Allergy 2021;76(2):428-455. https://doi.org/10.1111/all.14657
16. Koronavírus na Slovensku v číslach - Koronavírus a Slovensko https://korona.gov.sk/
17. *Adil, M.T., Rahman, R., Whitelaw, D., Jain, V., Al-Taan, O., Rashid, F., Munasinghe, A., Jambulingam, P.:* SARS-CoV-2 and the pandemic of COVID-19. Postgraduate Medical Journal 2021;97(1144):110-116. https://doi.org/10.1136/postgradmedj-2020-13838686
18. *Shah, S.G.S., Nogueras, D., van Woerden, H.C., Kiparoglou, V.:* The COVID-19 Pandemic: A Pandemic of Lockdown Loneliness and the Role of Digital Technology. Journal of Medical Internet Research 2020;22(11):e22287. doi: 10.2196/22287. https://preprints.jmir.org/preprint/22287
19. *Jones, E.A.K., Mitra, A.K., Bhuiyan, A.R.*: Impact of COVID-19 on Mental Health in Adolescents: A Systematic Review. International Journal of Environmental Research and Public Health 2021;18(5):2470. https://doi.org/10.3390/ijerph18052470
20. *Brinkhof, L.P., Ridderinkhof, K.R., van de Vijver, I., Murre, J.M.J., Krugers, H.J., de Wit, S.:* Psychological Coping and Behavioral Adjustment Among Older Adults in Times of COVID-19: Exploring the Protective Role of Working Memory and Habit Propensity. Journal of Adult Development 2022;29:240-254. https://doi.org/10.1007/s10804-022-09404-9
21. *Lyu, Z., Jackson, T.:* Acute Stressors Reduce Neural Inhibition to Food Cues and Increase Eating Among Binge Eating Disorder Symptomatic Women. Frontiers in Behavioral Neuroscience 2016;10:188. https://doi.org/10.3389/fnbeh.2016.00188
22. *Gluck, M.E., Geliebter, A., Hung, J., Yahav, E.*: Cortisol, hunger, and desire to binge eat following a cold stress test in obese women with binge eating disorder. Psychosomatic Medicine 2004;66(6):876-81. doi: 10.1097/01.psy.0000143637.63508.47. https://journals.lww.com/psychosomaticmedicine/Abstract/2004/11000/Cortisol,_Hunger,_and_Desire_to_Binge_Eat.12.aspx
23. *Gluck, M.E.:* Short Communication. Stress response and binge eating disorder. Appetite 2006;46 (1): 26–30. https://doi.org/10.1016/j.appet.2005.05.004
24. Alkandari, A., Law, J., Alhashmi, H,. Alshammari, O., Bhandari, P.: Staying (Mentally) Healthy: The Impact of COVID-19 on Personal and Professional Lives. Techniques and Innovations in Gastrointestinal Endoscopy 2021;23(2):199-206. https://doi.org/10.1016/j.tige.2021.01.003
25. *Iddir, M., Brito, A., Dingeo, G., Fernandez Del Campo, S.S., Samouda, H., La Frano, M.R., Bohn, T.:* Strengthening the Immune System and Reducing Inflammation and Oxidative Stress through Diet and Nutrition: Considerations during the COVID-19 Crisis. Nutrients 2020;12(6):1562. https://doi.org/10.3390/nu12061562
26. *Wu, D., Lewis, E.D., Pae, M., Meydani, S.N.:* Nutritional Modulation of Immune Function: Analysis of Evidence, Mechanisms, and Clinical Relevance. Front Immunol 2019;9:3160. https://doi.org/10.3389/fimmu.2018.03160
27. *Abbas, A.M., Kamel, M.M.:* Dietary habits in adults during quarantine in the context of COVID-19 pandemic. Obesity Medicine 2020;19:100254. https://doi.org/10.1016/j.obmed.2020.100254
28. *Ling, V., Zabetakis, I.:* The Role of an Anti-Inflammatory Diet in Conjunction to COVID-19. Diseases 2021;9(4):76. https://doi.org/10.3390/diseases9040076
29. *Zeigler, Z.:* COVID-19 Self-quarantine and Weight Gain Risk Factors in Adults. Current Obesity Reports volume 2021;10(3):423-433. https://doi.org/10.1007/s13679-021-00449-7
30. *Błaszczyk-Bębenek, E., Jagielski, P., Bolesławska, I., Jagielska, A., Nitsch-Osuch, A., Kawalec, P.*: Nutrition Behaviors in Polish Adults before and during COVID-19 Lockdown. Nutrients 2020;12(10):3084. https://doi.org/10.3390/nu12103084
31. *Barone Gibbs, B., Kline, C.E., Huber, K.A., Paley, J.L., Perera, S.*: Covid-19 shelter-at-home and work, lifestyle and well-being in desk workers. Occupational Medicine 2021;71(2):86-94. https://doi.org/10.1093/occmed/kqab011
32. *Kim, S.Y., Yoo, D.M., Min, C., Choi, H.G.:* Changes in Dietary Habits and Exercise Pattern of Korean Adolescents from Prior to during the COVID-19 Pandemic. Nutrients 2021;13(10):3314. https://doi.org/10.3390/nu13103314
33. Sidor, A., Rzymski, P.: Dietary Choices and Habits during COVID-19 Lockdown: Experience from Poland. Nutrients 2020;12(6):1657. https://doi.org/10.3390/nu12061657
34. *Ammar, A., Brach, M., Trabelsi, K., Chtourou, H., Boukhris, O., et al.:* Physical activity, dietary habits and sleep quality before and during COVID-19 lockdown: A longitudinal study. Appetite 2021;158:105019. https://doi.org/10.1016/j.appet.2020.105019
35. *Zupo, R., Castellana, F., Sardone, R., Sila, A., Giagulli, V.A., Triggiani, V., Cincione, R.I., Giannelli, G., De Pergola, G.:* Preliminary Trajectories in Dietary

Behaviors during the COVID-19 Pandemic: A Public Health Call to Action to Face Obesity. International Journal of Environmental Research and Public Health 2020;17(19):7073. https://doi.org/10.3390/ijerph17197073
36. *Kriaucioniene, V., Bagdonaviciene, L., Rodríguez-Pérez, C., Petkeviciene, J.*: Associations between Changes in Health Behaviours and Body Weight during the COVID-19 Quarantine in Lithuania: The Lithuanian COVIDiet Study. Nutrients 2020;12(10):3119. https://doi.org/10.3390/nu12103119
37. *Rodríguez-Pérez, C., Molina-Montes, E., Verardo, V., Artacho, R., García-Villanova, B., Guerra-Hernández, E.J., Ruíz-López, M.D.:* Changes in Dietary Behaviours during the COVID-19 Outbreak Confinement in the Spanish COVIDiet Study. Nutrients 2020;12(6):1730. https://doi.org/10.3390/nu12061730
38. *Bin Zarah, A., Enriquez-Marulanda, J., Andrade, J.M.*: Relationship between Dietary Habits, Food Attitudes and Food Security Status among Adults Living within the United States Three Months Post-Mandated Quarantine: A Cross-Sectional Study. Nutrients 2020;12(11):3468. https://doi.org/10.3390/nu12113468
39. *Di Renzo, L., Gualtieri, P., Pivari, F., Soldati, L., Attinà, A., Cinelli, G., Leggeri, C., Caparello, G., Barrea, L., Scerbo, F., Esposito, E., De Lorenzo, A*.: Eating habits and lifestyle changes during COVID-19 lockdown: an Italian survey. Journal of Translational Medicine 2020;18(1):229. https://doi.org/10.1186/s12967-020-02399-5
40. *Górnicka, M., Drywień, M.E., Zielinska, M.A., Hamułka, J.*: Dietary and lifestyle changes during COVID-19 and the subsequent lockdowns among Polish adults: A cross-sectional online survey PLife COVID-19 study. Nutrients 2020;12(8):2324. doi: 10.3390/nu12082324.
41. *Randall, T., Mellor, .C, Wilkinson, L.L.*: A Qualitative Study Exploring Management of Food Intake in the United Kingdom During the Coronavirus Pandemic. Frontiers in Psychology 2022;13:869510. https://doi.org/10.3389/fpsyg.2022.869510
42. *Balanzá-Martínez, V., Kapczinski, F., de Azevedo Cardoso, T., Atienza-Carbonell, B., Rosa, A.R., Mota, J.C., De Boni, R.B.*: The assessment of lifestyle changes during the COVID-19 pandemic using a multidimensional scale. Revista de Psiquiatría y Salud Mental 2021;14(1):16-26. https://doi.org/10.1016/j.rpsm.2020.07.003
43. *Martínez-de-Quel, Ó., Suárez-Iglesias, D., López-Flores, M., Pérez, C.A.:* Physical activity, dietary habits and sleep quality before and during COVID-19 lockdown: A longitudinal study. Appetite 2021;158:105019. https://doi.org/10.1016/j.appet.2020.105019
44. *Romero-Blanco, C., Rodríguez-Almagro, J., Onieva-Zafra, M.D., Parra-Fernández, M.L., Prado-Laguna, M.D.C., Hernández-Martínez, A*.: Physical Activity and Sedentary Lifestyle in University Students: Changes during Confinement Due to the COVID-19 Pandemic. International Journal of Environmental Research and Public Health 2020;17(18):6567. https://doi.org/10.3390/ijerph17186567
45. *Gallè, F., Sabella, E.A., Ferracuti, S., De Giglio, O., Caggiano, G., Protano, C., Valeriani, F., Parisi, E.A., Valerio, G., Liguori, G., Montagna, M.T., Romano, Spica, V., Da Molin, G., Orsi, G.B., Napoli, C.:* Sedentary Behaviors and Physical Activity of Italian Undergraduate Students during Lockdown at the Time of CoViD-19 Pandemic. International Journal of Environmental Research and Public Health 2020;17(17):6171. https://doi.org/10.3390/ijerph17176171
46. *Xiang, M., Zhang, Z., Kuwahara, K.:* Impact of COVID-19 pandemic on children and adolescents' lifestyle behavior larger than expected. Prog Cardiovasc Dis. 2020;63(4):531-532. https://doi.org/10.1016/j.pcad.2020.04.013
47. *Park, A.H., Zhong, S., Yang, H., Jeong, J., Lee, C.*: Impact of COVID-19 on physical activity: A rapid review. Journal of global Health 2022;12:05003. doi: 10.7189/jogh.12.05003. https://www.ncbi.nlm.nih.gov/pmc/journals/1902/
48. *Martinez-Ferran, M., de la Guía-Galipienso, F., Sanchis-Gomar, F., Pareja-Galeano, H.*: Metabolic Impacts of Confinement during the COVID-19 Pandemic Due to Modified Diet and Physical Activity Habits. Nutrients 2020; 12(6):1549. https://doi.org/10.3390/nu12061549
49. *Rentería, I., García-Suárez, P.C., Moncada-Jiménez, J., Machado-Parra, J.P., Antunes, B.M., Lira, F.S., Jiménez-Maldonado, A.*: Unhealthy Dieting During the COVID-19 Pandemic: An Opinion Regarding the Harmful Effects on Brain Health. Frontiers in Nutrition 2022;9:876112. https://doi.org/10.3389/fnut.2022.876112
50. *Abdurahman, A.A., Bule, M., Shab-Bidar, S., Rezaei, S., Djafarian, K.*: The association between sleep duration and risk of abnormal lipid profile: a systematic review and meta-analysis. Obesity Medicine 2020;18:100236. https://doi.org/10.1016/j.obmed.2020.100236
51. *Song, Q., Liu, X., Zhou, W., Wu, S., Wang, X.:* Night sleep duration and risk of each lipid profile abnormality in a Chinese population: a prospective cohort study. Lipids in Health and Disease 2020;19(1):185. https://doi.org/10.1186/s12944-020-01363-y
52. *Kruisbrink, M., Robertson, W., Ji, C,. Miller, M.A., Geleijnse, J.M., Cappuccio, F.P.:* Association of sleep duration and quality with blood lipids: a systematic review and meta-analysis of prospective studies. BMJ Open 2017;7(12):e018585. http://dx.doi.org/10.1136/bmjopen-2017-018585
53. *Daniels, N.F., Burrin, C., Chan, T., Fusco, F.*: A Systematic Review of the Impact of the First Year of COVID-19 on Obesity Risk Factors: A Pandemic Fueling a Pandemic? Current Developments in Nutrition 2022;6(4):nzac011. https://doi.org/10.1093/cdn/nzac011

Received: 19.04.2023
Accepted: 05.07.2023
Published online first: 26.07.2023